INT J LANG COMMUN DISORD, MAY–JUNE 2011,
VOL. 46, NO. 3, 334–347

Research Report

Literacy skills in primary school-aged children with pragmatic language impairment: a comparison with children with specific language impairment

Jenny Freed, Catherine Adams and Elaine Lockton

Human Communication and Deafness, University of Manchester, Manchester, UK

(*Received 24 December 2009; accepted 7 June 2010*)

Background: Children with pragmatic language impairment (CwPLI) are characterized by difficulties with the interpersonal use of language in social contexts and they possess a range of language difficulties that affect their educational attainment. Since literacy skills are central to this attainment, one way of identifying appropriate support needs for CwPLI would be to profile their reading and writing skills as a group.
Aims: To investigate the word reading, non-word reading, reading comprehension, and written expression skills of CwPLI and a comparison group of children with specific language impairment (CwSLI). CwSLI were recruited in order to examine any overlaps in literacy impairments for the two groups.
Methods & Procedures: Primary school-aged CwPLI ($n = 59$) and CwSLI ($n = 12$) were recruited from speech and language therapists. Children completed standardized assessments of literacy skills. The level of impairment for each component literacy skill was examined for CwPLI and CwSLI.
Outcomes & Results: For the CwPLI, group mean scores on each of the literacy skills were at the lower end of the normal range compared with population norms. The range of individual scores was large, with some children scoring near floor level and others scoring up to 2 SDs (standard deviations) above the mean, illustrating the heterogeneity of literacy skills within the group. For the CwSLI, group mean scores on each of the literacy skills were between 1 SD and 2 SDs below the population mean. CwSLI were significantly more impaired on all of the literacy measures compared with CwPLI. This difference remained even when receptive language ability and non-verbal intelligence were controlled for.
Conclusions & Implications: The results demonstrate that there is a high level of literacy impairment within CwPLI and CwSLI, providing evidence that individualized literacy skill intervention is important for the long-term academic outcome of these children.

Keywords: pragmatic language impairment, specific language impairment, literacy, reading, writing.

What this paper adds

What is already known on this subject?

Children with pragmatic language impairment (CwPLI) are well known for their difficulties with the use of language in social contexts. This has an impact upon their educational attainment. However, the literacy skills of this group had not previously been explored.

What this paper adds?

The present study examined the reading and writing skills of a group of CwPLI and a comparison group of children with specific language impairment (CwSLI). This provides an indication of the level of literacy impairment present in these children. These findings have implications for the provision of literacy intervention for CwPLI and CwSLI.

Introduction

Children with pragmatic language impairment (CwPLI) are characterized by persistent social and communication difficulties which affect their educational attainment (Botting and Conti-Ramsden 1999). Whilst CwPLI tend to have normal range language skills in terms of phonology and syntax, they are impaired in the use of language in social contexts (Leinonen *et al.* 2000) and have difficulty with above-sentence level language

Address correspondence to: Jenny Freed, Human Communication and Deafness, University of Manchester, Oxford Road, Manchester, M13 9PL, UK; e-mail: jenny.freed@manchester.ac.uk

International Journal of Language & Communication Disorders
ISSN 1368-2822 print/ISSN 1460-6984 online
DOI: 10.3109/13682822.2010.500316

processing tasks such as narrative organization, inference generation and comprehension of information (Botting and Adams 2005). In addition to having higher level language impairments, they also show some autistic features, but typically do not meet diagnostic criteria for autism (Bishop and Norbury 2002).

The profile of literacy abilities in this group remains unclear and the relative contributions of pragmatic and language limitations have not been explored. A first step in this enquiry is to compare the literacy skill profiles of CwPLI with a group of children with specific language impairment (CwSLI). This group presents persistent difficulty in acquiring language normally despite having normal intelligence. Specific language impairment (SLI) is usually defined using exclusionary criteria, for example: no hearing loss, no neurological cause and no severe social and emotional problems (Bishop 1992). SLI is a heterogeneous group with most children experiencing difficulties with comprehension and others having significant problems with expressive language (Bishop 1998). By comparing the literacy skills of the two groups, there is an opportunity to examine the relative contributions of underlying language impairment to literacy development and to ascertain if there is overlap between the two groups' literacy profiles.

Relationship between PLI, SLI and autism

The question of how PLI fits amongst other disorders such as SLI and autistic spectrum disorders (ASD) remains unresolved and therefore the use of PLI as a diagnostic label continues to be controversial. There has been a great deal of research into the reasons whether PLI should or should not be considered a subtype or correlate of SLI or autism (for example, Bishop 2000) and there are currently no clear cut criteria to differentiate PLI from SLI and autism (Bishop 2000, Bishop and Norbury 2002). Bishop (2000) states that, although CwPLI possess some of the language characteristics of SLI and some of the mild social communication difficulties of high functioning autism or Asperger's syndrome, they do not have significant impairments in all three aspects of the autism triad and therefore do not meet diagnostic criteria for autism (Bishop and Norbury 2002). In contrast, Shields *et al.* (1996) argue that PLI is a form of high-functioning autism; however, this assertion was based on results from tests of social cognition only.

Whilst the existence of PLI is still under debate, we argue that there are children presenting in speech and language therapy clinics whose primary difficulty is in pragmatics (with or without additional structural language problems). It is important, therefore, to understand the impact that their difficulties may have on their academic achievement. The authors, although not seeking to position PLI as a diagnostic category or 'clinical condition', suggest that establishing such an experimental subgroup for the purposes of research enables us to explore children with different but overlapping language processes. CwPLI require an intervention approach which is distinct from that of children with purely structural language difficulties and have a distinct set of long-term outcomes. The approach of categorizing children into discreet groups has also been used by other researchers. For example, Bishop *et al.* (2009) categorized groups of children with language impairment and/or dyslexia. They argued that their categorical approach enabled them to ask the clinically relevant questions, but acknowledged that the definitions of the groups were based on continuous variables and therefore the choice of specific cut-offs is arbitrary.

The terms 'PLI' and 'SLI' are familiar to paediatric speech and language therapists, and speech and language therapists in the present study were able to identify CwPLI and CwSLI using expert clinical opinion. Therefore, using such terms allows an exploration of the strengths and difficulties of children described as having PLI or SLI in clinics today. The use of expert clinical opinion to recruit CwPLI or CwSLI has also been adopted by researchers in other studies (for example, Adams *et al.* 2006, 2009, Norbury *et al.* 2004). In the present study we also conducted additional assessments to back up the selection of participants for each group.

It should also be noted that the definition of SLI, or inclusion criteria used to recruit groups of CwSLI is still an unresolved issue with different researchers arguing for different levels of impairment on specific measures. Whilst the boundaries in terms of level of impairment shift, it is generally accepted that CwSLI have language skills below the population norms and non-verbal intelligence within the normal range, and this is the position adopted in the present study.

Literacy skills

Both reading and writing aspects of literacy will be considered in this paper. Reading will be explored via (1) assessment of word recognition of real words and non-words, which are in turn thought to be governed by phonological decoding skills and letter knowledge, and may be influenced by word recognition skills; and (2) text comprehension, which is also influenced by word recognition skills and non-phonological skills such as semantics, morphology and pragmatics (Nation and Norbury 2005). Writing will be explored via a range of tasks, including composition and spelling. A variety of tasks are required since research has demonstrated that ability in one aspect of writing does not necessarily

predict ability in another aspect, for example: good spelling skill does not automatically result in good written narrative skills (Cragg and Nation 2006).

Literacy skills in children who have autism and/or language impairments

There is no research, to our knowledge, that has explored the literacy skills of CwPLI specifically. However, there has been extensive research into the literacy skills of CwSLI and children with autism. As it has been suggested that PLI 'shares some of the processing limitations of both groups [SLI and autism] in social, social cognitive and language domains' (Adams *et al.* 2006: 44), and some researchers (for example, Shields *et al.* 1996) believe that PLI is a form of high functioning autism, predictions can be made about the literacy skills of CwPLI by examining research into the literacy skills of children with autism and SLI.

Reading ability

Nation *et al.* (2006) showed that there is considerable individual variability in reading accuracy and reading comprehension skills for children with autism, and scores on assessments can range from floor to near ceiling. However, as a group, it is generally reported that children with autism have age-appropriate word reading skills (Minshew *et al.* 1994, O'Connor and Klein 2004, Nation *et al.* 2006). Nation *et al.* (2006) recruited a group of children with ASD allowing heterogeneous diagnoses ranging from autism to Asperger's syndrome. There was a wide range in vocabulary and comprehension abilities in the group with some children performing at floor level. They found that 22% of participants were completely unable to decode words, whilst the remaining children had mean reading accuracy scores within the normal range.

Reports of non-word reading ability in children with autism have varied, with some researchers reporting no differences between word reading and non-word reading ability (for example, Minshew *et al.* 1994) and others reporting better word than non-word reading skills (for example, Nation *et al.* 2006). This difference may be due to the sampling methods used; Minshew *et al.* recruited a high functioning autistic group (IQ $>$ 70), whilst Nation *et al.* did not recruit based on intelligence level.

As Nation *et al.* (2006) hypothesized, the poorer non-word reading accuracy reported in children with ASD, suggests poor phonological decoding which could, in turn, be associated with underlying language impairments. This contrasts to children with ASD's better ability to read real words which could be due to using rote memorization or visual association strategies, skills which would not be useful when attempting to decode novel non-words.

Reading comprehension ability in children with autism has been generally found to be poorer than decoding skills (Minshew *et al.* 1994, O'Connor and Klein 2004, Nation *et al.* 2006). Nation *et al.* (2006) found that reading comprehension skills were, on average, 1 SD (standard deviation) below the population norms. More specifically, 65% of the sample had a reading comprehension standard score at least 1 SD below the population norms, and 38% scored more than 2 SDs below the population norms.

As Nation and Norbury (2005) suggest, the reading comprehension skills of children with autism may be constrained by their difficulties with comprehension monitoring and drawing inferences. It has been hypothesized that these children tend not to automatically draw inferences using their existing knowledge to assist with comprehension. They may also fail to recognize prominent information due to their poor social cognition skills (O'Connor and Klein 2004, Snowling and Frith 1986, Shields *et al.* 1996).

In general, studies suggest that children with autism tend to have reading accuracy skills in advance of their reading comprehension skills. This discrepancy between skills has led some researchers to debate whether these children have hyperlexia (above-average reading accuracy skills, with significant impairment in reading comprehension). However, this debate is still ongoing (Grigorenko *et al.* 2002, O'Connor and Klein 2004, Nation and Norbury 2005).

In contrast to studies of children on the autistic spectrum, CwSLI have generally been found to be poor at both reading words and non-words and reading comprehension skills (Briscoe *et al.* 2001, Snowling *et al.* 2000). Conti-Ramsden *et al.* (2001) found that the majority of their group of children with a history of SLI had impaired word reading and reading comprehension ability, defined as scores at least 1 SD below the population mean. Briscoe *et al.* (2001) showed that word reading, non-word reading and reading comprehension skills of CwSLI were significantly lower than those of an age-matched control group and a language-matched (based on receptive vocabulary) control group. Therefore, this group of CwSLI were performing more poorly than would be predicted by their language skills.

Written ability

There has been limited research examining the written skills of children with autism. Minshew *et al.* (1994) found that children with high functioning autism could spell at an age appropriate level. However, little is known about their written narrative skills. The research into the written skills of CwSLI is more comprehensive. Mackie and Dockrell (2004) showed that CwSLI wrote fewer words and made proportionally more

written syntax errors than a chronological age-matched control group. Windsor *et al.* (2000) found that the number of verb composite errors was the key factor that differentiated children with language impairments from typically developing children. Specifically, the children with language impairments made proportionately more errors with the past tense *-ed*. Other research has found that the written and oral narratives of CwSLI had less grammatical complexity, more grammatical errors and were lower in quality than typically developing peers. In addition, in comparison to their peers, CwSLI showed a slower rate of development between testing at age 7–8 and at age 9–10 on measures of story length and story quality (Fey *et al.* 2004). Dockrell *et al.* (2007), in a study of written narratives, showed that CwSLI wrote slowly, producing short texts with poor sentence structure and organization, compared with an age-matched sample. Some studies have found no difference in the proportion of spelling errors produced by CwSLI compared with typically developing children (Bishop *et al.* 2009, Mackie and Dockrell 2004). In contrast, other studies have found that CwSLI produce writing which has a high number of spelling errors (Dockrell *et al.* 2007, Bishop and Clarkson 2003). It has been suggested that this is due to their limited phonological awareness and the errors are often phonological errors rather than orthographically illegal errors (Bishop and Clarkson 2003, Dockrell *et al.* 2007).

In summary, it can be seen that reading and writing are complex processes which require a number of skills, including phonological decoding, grammatical competence and comprehension of context to be successful. Both children with autism and CwSLI show a range of ability in literacy but the latter group have more marked difficulties with all aspects of literacy attainment. Therefore, if PLI is a condition in which elements of autism and SLI coexist to varying degrees, one might expect to see both the reading comprehension difficulties of autism and the phonological decoding difficulties of SLI impinging on the development of reading and writing skills. However, it is clear that the heterogeneity identified by Nation *et al.* (2006) may also be represented in the PLI group and that generally CwPLI may perform better than an SLI group if their phonological decoding skills deficit is relatively mild.

This paper deliberately parallels that of Nation *et al.* (2006) since it assesses written ability in addition to reading accuracy and reading comprehension. It differs to Nation *et al.* because it explores literacy skills in CwPLI and a comparison group of CwSLI. It is possible of course, that, if PLI really represents one end of the autism spectrum (as some have argued) there will be some similarities in the reading skills of the two groups. The similarities and differences between the literacy skills of CwPLI in the present study and the children with ASD in Nation *et al.*'s study will be explored in the Discussion. It should be noted, however, that the present study used a different measure of reading ability due to the floor effects observed by Nation *et al.*

Research questions

The specific research questions explored in this study are therefore as follows:

- What is the level of word reading (when presented either in isolation or in a linguistic context) and non-word reading ability in a group of CwPLI, and how does this compare to a group of CwSLI? Given the heterogeneous nature of PLI, it would be expected that the range of scores would be relatively large. If PLI is an intermediate condition between SLI (associated with poor word and non-word reading) and autism (associated with normal range word reading and equivocal findings on non-word reading), it would be predicted that mean word reading and non-word reading scores would be at the lower end of the normal range. It would be predicted that CwPLI would have better word reading skills than CwSLI because of the difficulties that CwSLI have with phonological awareness.
- What is the level of reading comprehension ability in a group of CwPLI, and how does this compare to a group of CwSLI? It would be predicted that CwPLI would be impaired at reading comprehension due to their difficulties with inference generation (above sentence level processing). CwSLI would be expected to have poor reading comprehension ability, due to language processing limitations, which may be be more marked than those of CwPLI. Reading comprehension ability in the groups will also be compared controlling for word reading ability.
- What is the level of writing ability in a group of CwPLI, and how does this compare to CwSLI? It would be predicted that both groups would show impairment in written tasks, and based on the predictions related to the other literacy skills, it would be expected that CwPLI would be less impaired than CwSLI.

Methods

Participants

Recruitment of the PLI and SLI group was completed by using a combination of speech and language therapist expert clinical opinion of either PLI or SLI, together with a number of additional inclusion assessments as detailed below. Participants in the PLI group ($n = 59$)

were recruited from a cohort of 85 CwPLI taking part in the Social Communication Intervention Project (SCIP), a randomized controlled trial (RCT) of intervention for CwPLI (Adams *et al.* in preparation). All parents of children involved in the SCIP project were approached to seek consent to allow their child's data to be used in the present study. Seventy parents consented, and 59 of these met inclusion criteria. All children were on National Health Service (NHS, the UK publicly funded medical and health services) speech and language therapy caseloads in the North West of England and South East Scotland and were aged between 6;00 and 10;11 years old. All children attended mainstream school, were identified as having special educational needs and had English as their primary language of communication and learning. None of the children had severe emotional or behaviour needs, severely unintelligible speech, severe physical difficulties or hearing loss. All children were considered, by their speech and language therapists to have PLI and to meet at least two of the following aspects of social communication impairment:

- Difficulty understanding and interpreting social context and friendship, for example, social roles, emotions.
- Difficulty understanding and/or using non-verbal aspects of communication for example, facial expression, intonation.
- Difficulty with aspects of conversation for example, beginning and ending, taking turns, giving relevant and sufficient information.
- Makes bizarre, tangential or inappropriate comments.
- Difficulty using and understanding non-literal language in social interactions.

All CwPLI had a score of 58 or below on the General Communication Composite (GCC) of the Children's Communication Checklist 2nd Edition (CCC-2; Bishop 2003a), completed by parents. This cut-off was used as it indicates a score in the communication-impaired range. The GCC was used to confirm the presence of communication impairment if a child scored in the normal range on language tests (Some CwPLI obtain scores in the normal range on standardized language tests, but still experience significant communication difficulties. In the present sample, 39% of CwPLI obtained standard scores in the normal range on the measure of receptive language (Clinical Evaluation of Language Fundamentals 4th Edition UK (CELF-4^{UK}); Semel *et al.* 2006)). CwPLI were also required to have a score of 8 or below on the Social Interaction Deviance Composite (SIDC) of the CCC-2. The SIDC identifies children who have a disproportionate impairment in pragmatic aspects of communication compared with other aspects of language and was therefore used to differentiate the groups. All children had non-verbal intelligence abilities within the normal range (greater than or equal to fifth centile) on the Raven's Coloured Progressive Matrices (CPM; Raven 1979).

A comparison group of 12 CwSLI were recruited from NHS speech and language therapists in the North West of England and from specialist language resources attached to mainstream schools. CwSLI met the same criteria for inclusion as CwPLI, except for the following

- A score of less than 55 on the GCC of the CCC-2 (Bishop 2003a). This cut-off was used because nearly all CwSLI in the CCC-2 standardization sample obtained a score below this level on the GCC.
- A score greater than or equal to 9 on the SIDC of the CCC-2.
- Either a standard score of less than 8 on the Assessment of Comprehension and Expression naming subtest (ACE; Adams *et al.* 2001) and/or a standard score of less than 80 on the Test for Reception of Grammar 2nd Edition (TROG-2; Bishop 2003b).

All participants' characteristics can be seen in table 1. It also shows group differences on each of the participant characteristics using *t*-tests.

Table 1. Participant characteristics

	PLI group ($n = 59$, 52 males)			SLI group ($n = 12$, 8 males)			
	Mean	SD	Range	Mean	SD	Range	Group difference (p-value)
Age (years;months)	8;6	1;3	6;0–10;8	7;9	1;6	6;1–10;10	0.077
GCC score on CCC-2	29.58	12.36	6–57	31.17	12.25	15–54	0.685
SIDC score on CCC-2	−3.19	8.11	−26 to 8	17.92	8.24	9–31	<0.001**
Ravens CPM[a]	55.18	28.02	7.5–96	46.04	19.26	7.5–82.5	0.183
CELF RLI[b]	79.92	16.38	45–113	74.33	12.62	57–99	0.270

Notes: [a]Raw scores on the Ravens CPM are transformed into age-adjusted percentile ranges. For ease of statistical comparison, these ranges were transformed further into percentile midpoints for that range, for example, 5th–10th percentile becomes the 7.5th percentile.
[b]Standard scores (mean = 100, standard deviation (SD) = 15).
**$p < 0.01$. CPM, coloured progressive matrices; RLI, receptive language index.

Measures

Inclusion measures and language measure

The following measures were used as inclusion criteria for the PLI and/or SLI groups as detailed above and reliabilities are included for each measure in brackets: (1) Children's Communication Checklist 2nd Edition (CCC-2; Bishop 2003a) (all subscales $\alpha > 0.65$); (2) Raven's Coloured Progressive Matrices (CPM; Raven 1979) ($\alpha = 0.80$–0.93); (3) ACE naming subtest (Adams *et al.* 2001) ($\alpha = 0.78$); and (4) TROG-2 (Bishop 2003b) ($\alpha = 0.88$). The CELF-4^{UK} (Semel *et al.* 2006) Receptive Language Index (RLI) standard score, calculated using three subtests (concepts and following directions, word classes-receptive and sentence structure) ($\alpha = 0.89$) was completed by all children (17% of CwSLI obtained standard scores in the normal range on this measure).

Literacy measures

Four subtests (word reading, reading comprehension, pseudo-word decoding (measuring non-word reading) and written expression) were administered from the Wechsler Individual Achievement Test—Second UK Edition (WIAT-II^{UK}; Wechsler 2005). The WIAT-II^{UK} is designed to reflect reading instruction in school. It has a broad range of item difficulty and is designed to appeal to children with language learning difficulties. It avoids the floor effects of the Neale Analysis of Reading Ability (NARA; Neale 1997) found in Nation *et al.*'s (2006) ASD group and also avoids some of the concerns over the independence of the NARA's accuracy and comprehension measures (Spooner *et al.* 2004). The WIAT-II^{UK} has good reliability ($\alpha \geq 0.95$ for word reading, pseudo-word decoding and reading comprehension. Split half reliability could not be computed for written expression due to the nature of the item content so test–retest reliability is reported instead ($r = 0.86$)).

Reading accuracy. The word reading (WR) subtest is designed to assess pre-reading (phonological awareness) and decoding skills. This subtest is graded and consists of a number of components. The pre-reading skills include reading letters of the alphabet, answering questions about rhyming words, identifying letter sounds at the beginning and end of words, blending sounds into words and matching sounds with letters and letter groups. The second part of the test requires the child to read out loud single words which are presented out of context.

The pseudo-word decoding (or non-word reading (NWR)) subtest is designed to assess the child's ability to use phonetic decoding skills. The child is asked to read out loud a list of nonsense words which reflect the phonetic structure of English. This produces a NWR standard score. This test will be referred to as NWR rather than pseudo-word decoding in the results and discussion for consistency.

Reading comprehension. The reading comprehension (RC) subtest assesses the child's ability to match written words with pictures, to answer comprehension questions on passages of text requiring inference and to answer comprehension questions about short sentences that they have to read aloud. This subtest is designed to reflect reading instruction in school. This subtest produces an overall RC standardized score and a quartile score for target words, a measure of reading accuracy ability for words presented in context (RContx).

Written skills. The written expression (WE) subtest assesses the child's ability to write the letters of the alphabet, generate and write a list of words according to a specific category, combine two or three short sentences into one sentence, generate sentences from pictures, and write a paragraph about a particular theme. This subtest mainly looks at a child's sentence and narrative ability rather than their spelling ability.

The written expression subtest also allows the calculation of two supplemental quartile scores: (1) word fluency ability. This requires the child to generate and write a list of words that fit a named category, children receive credit based on the number of suitable words that are produced and extra marks are given for words which have more than one syllable; and (2) number of words which are written in the paragraph. The paragraph component is only completed by children aged eight and over.

Procedure

Children were tested in a quiet room in their schools. The measures were completed in one or two sessions lasting no longer than two hours each. Regular breaks were given as required. The data for the PLI group was collected before the intervention phase of the RCT in which they were also involved. Children were not told whether they were answering questions correctly, but positive encouragement was given throughout the session according to the assessment manual. Assessments were administered by the first author, or another member of the SCIP research staff.

Analysis

Each of the aspects of literacy skill (reading accuracy, reading comprehension and written expression) were analysed in turn. The mean and range of scores for each measure was analysed. This was followed by an examination of the distribution of scores on each subtest to examine the percentage of children scoring at least 1 SD and at least 2 SDs below the population mean. Analyses of covariance (ANCOVAs) were then

conducted to compare group differences (PLI or SLI) on each of the literacy measures. Non verbal intelligence, calculated using Raven's percentile (NVIQ) and receptive language ability (RL) were included in each ANCOVA as covariates. These two covariates were used as they were considered the most important given that the groups were unmatched, and there are limits to the number of covariates that can be included with a small sample size. Additional analyses were also conducted related to the individual literacy measures. These are detailed below in the relevant sections.

Results

Table 2 summarizes scores on the four component literacy skills. It should be noted that standard scores for all subtests on the WIAT-II^{UK} can range from 40 to 160.

Reading accuracy: word reading and non-word reading

The aim of the first research question was to explore word reading and non-word reading ability in CwPLI and CwSLI, and to make comparisons between these two groups. In order to address this aim two ANCOVAs were conducted. The first ANCOVA was conducted to compare group ability on WR for CwPLI and CwSLI using NVIQ and RL as covariates. The data was checked for homogeneity of variances ($F(1,69) = 2.77$, $p = 0.101$). There was a significant effect of participant group after controlling for the covariates ($F(1,67) = 5.51$, $p = 0.022$, partial $\eta^2 = 0.076$). CwPLI scored significantly higher than CwSLI on WR (see table 2 for descriptive statistics). The covariates, RL ($F(1,67) = 13.12$, $p = 0.001$, partial $\eta^2 = 0.164$) and NVIQ ($F(1,67) = 6.14$, $p = 0.016$, partial $\eta^2 = 0.084$), were also significantly related to WR ability.

The second ANCOVA repeated the first, but this time with NWR ability as the dependent variable to examine between group differences for NWR.[1] Once again, homogeneity of variances was checked ($F(1,62) = 0.014$, $p = 0.907$). There was a significant effect of participant group after controlling for the covariates ($F(1,60) = 6.08$, $p = 0.017$, partial $\eta^2 = 0.092$). CwPLI scored significantly higher than CwSLI on NWR (for descriptive statistics, see table 2). The covariate, RL ($F(1,60) = 5.64$, $p = 0.021$, partial $\eta^2 = 0.086$) was significantly related to NWR ability, whilst NVIQ ($F(1,60) = 2.82$, $p = 0.098$, partial $\eta^2 = 0.045$) was not.

For CwPLI, mean reading accuracy standard scores (measured by WR and NWR) were within normal range, but at the lower end of normal range (table 2). The range of individual reading accuracy scores was large, with some children scoring near floor level and others scoring approximately 1 SD above the mean. For CwSLI, mean standard scores on the reading accuracy measures were approximately 2 SDs below the mean indicating that as a group, CwSLI have difficulty with reading accuracy. The range of scores was narrower than for the PLI group, but scores still ranged from near floor to near the population mean.

In order to examine the distribution of scores on each subtest, the number of children scoring within the normal range, at least 1 SD (standard score < 85) and at least 2 SDs (standard score < 70) below the population mean was examined. This provides an indication of the number of children who have scores within the impaired range in each aspect of literacy. Table 3 shows that just over 40% of the CwPLI and just over 80% of CwSLI had impaired reading accuracy ability, as defined by standard scores at least 1 SD below the mean (note that this column also includes children who scored two or more SDs below the mean).

Children completed different parts of the WR subtest depending on their age. Children aged under eight were presented with the pre-reading items and single word reading items, whilst children aged eight and above were only presented with the single word reading items. To address concerns that these items might not be tapping the same construct, additional statistical tests were conducted which found no significant differences between the standard scores attained by younger children presented with both the pre-reading and single word items ($n = 23$ CwPLI and $n = 8$ CwSLI) and older children ($n = 36$ CwPLI and $n = 4$ CwSLI) presented with the single word reading items only

Table 2. Mean standard scores, standard deviations (SDs), and range of scores on the WIAT-II^{UK} subtests

	PLI group ($N = 59$)[a]				SLI group ($N = 12$)			
	Mean	SE	SD	Range of scores	Mean	SE	SD	Range of Scores
Word reading	86.66	2.10	16.10	52–119	73.42	2.92	10.12	56–88
Non-word reading	88.83	1.84	13.26	65–118	77.67	2.25	7.78	68–89
Reading comprehension	85.86	1.92	14.75	45–110	73.42	2.80	9.71	60–92
Written expression	87.97	1.85	14.23	61–130	78.08	2.19	7.57	65–92

Notes: Standard scores (mean = 100, SD = 15). [a]$n = 52$ for non-word reading.

Table 3. Percentages of participants scoring within the normal range, at least 1 SD (standard deviation) below the mean and at least 2 SDs below the mean on the WIAT-II[UK] subtests

	PLI group ($n = 59$)[a]			SLI group ($n = 12$)		
Assessment	SS 85 or above	SS at least 1 SD below mean	SS at least 2 SD below mean	SS 85 or above	SS at least 1 SD below mean	SS at least 2 SD below mean
Word reading	57.6	42.4	15.3	16.7	83.3	41.7
Non-word reading	59.6	40.4	7.7	16.7	83.3	8.3
Reading comprehension	59.3	40.7	10.2	8.3	91.7	41.7
Written expression	57.6	42.4	8.5	25.0	75.0	16.7

Note. SS, standard score. [a]$n = 52$ for non-word reading.

($t(57) = 1.03$, $p = 0.307$ for CwPLI and $t(10) = 0.42$, $p = 0.679$ for CwSLI).

Word reading in isolation and in context

Group performance on reading words presented in isolation (WR subtest) and reading words in context (RContx) was then compared. The RContx quartile score was a RC supplemental score and could only be calculated for those children who completed the age-appropriate RC item set ($n = 48$ CwPLI, $n = 11$ CwSLI). The WR standard scores were converted into quartile scores to allow comparisons to be made. Table 4 shows the number of children obtaining scores in each quartile for WR and RContx. The majority of the CwPLI scored in either the first or second quartile for both WR and RContx. All of the CwSLI attained WR standard scores that were in the first quartile. For RContx, most CwSLI scored in the first quartile, and the remaining participants scored in the second quartile.

Reading comprehension

The second research question aimed to examine RC ability within and between the two groups. An ANCOVA was conducted to compare RC ability for CwPLI and CwSLI using NVIQ and RL as covariates. Homogeneity of variances was checked ($F(1,69) = 0.85$, $p = 0.361$). There was a significant effect of participant group after controlling for the covariates ($F(1,67) = 6.15$, $p = 0.016$, partial $\eta^2 = 0.084$). CwPLI scored significantly higher than CwSLI on RC (for descriptive statistics, see table 2). The covariates, RL ($F(1,67) = 23.45$, $p < 0.001$, partial $\eta^2 = 0.259$) and NVIQ ($F(1,67) = 4.32$, $p = 0.041$, partial $\eta^2 = 0.061$), were also significantly related to RC ability.

Mean RC scores were approximately 1 SD below the mean for CwPLI and nearly 2 SDs below the mean for CwSLI (table 2). The range of scores was large, particularly for CwPLI where they ranged from near floor to approximately 1 SD above the mean. As can be seen in table 3, 40.7% of the PLI group and the 11 of the 12 children in the SLI group attained scores that were at least 1 SD below the mean indicating low levels of RC ability, particularly in the SLI group where only one child scored in the normal range.

Word reading compared with reading comprehension

WR and RC skills were compared and there was a significant correlation for CwPLI ($r = 0.81$, $n = 59$, $p < 0.01$). It was expected that the relation between WR and RC would be strong, and that good WR skills would facilitate RC, therefore group differences would disappear if WR was controlled for. Therefore, an ANCOVA was conducted to compare RC ability

Table 4. Number of participants obtaining scores in each quartile for single-word reading and word reading in context (RContx)

	Word reading standard score translated into quartile score									
	PLI group ($n = 48$)					SLI group ($n = 11$)				
Reading in context quartile	1	2	3	4	Total	1	2	3	4	Total
1	16	1	0	0	17	9	0	0	0	9
2	4	8	4	0	16	2	0	0	0	2
3	0	2	2	0	4	0	0	0	0	0
4	1	4	3	3	11	0	0	0	0	0
Total	21	15	9	3	48	11	0	0	0	11

for CwPLI and CwSLI using WR score as a covariate. Homogeneity of variances was checked ($F(1,69) = 0.01$, $p = 0.938$). There was no significant effect of participant group after controlling for WR ($F(1,68) = 0.96$, $p = 0.332$, partial $\eta^2 = 0.014$). The covariate, WR was significantly related to RC ability ($F(1,68) = 113.25$, $p < 0.001$, partial $\eta^2 = 0.625$), showing that RC skills are affected by a child's WR ability.

Written ability

The final research question aimed to examine the level of written ability in the two groups and make comparisons between these groups. An ANCOVA was conducted to compare ability between groups on WE using NVIQ and RL as covariates. Homogeneity of variances was checked, and a significant difference was found between groups ($F(1,69) = 5.40$, $p = 0.023$). There was no significant effect of participant group after controlling for the covariates ($F(1,67) = 3.65$, $p = 0.060$, partial $\eta^2 = 0.052$). The covariate, RL ($F(1,67) = 17.77$, $p < 0.001$, partial $\eta^2 = 0.210$) was significantly related to WE ability, whilst the covariate NVIQ ($F(1,67) = 1.92$, $p = 0.170$, partial $\eta^2 = 0.028$) was not. In order to account for the homogeneity of variances assumption being violated, we conducted an additional analysis with bootstrapping using the percentile method. The bootstrapping method is more precise so although the effect is borderline significant, the results seem to be robust to the impact of variance heterogeneity and the confidence intervals (95% confidence interval (CI) (-11.48 to -2.50) indicate that $p < 0.05$ (for descriptive statistics, see table 2).

Mean standard scores on the WE subtest were at the lower end of the normal range for CwPLI and lower than 1 SD below the population mean for CwSLI (table 2). In line with the other literacy skills, just over 40% of the PLI group and three quarters of the SLI group had scores at least 1 SD below the population norms (table 3).

Written ability was explored in more depth by examining the supplemental scores. On the word fluency task, 47 of the 59 CwPLI and ten of the 12 CwSLI obtained a score that was in the first quartile. Children in both groups found it difficult to produce a list of appropriate words within a short time frame, according to population norms. For the paragraph word count, 30 of the 38 CwPLI who completed the paragraph had a word count that was in the second quartile or below. Therefore, the average number of words written by CwPLI was lower than the standardization sample. Two of the five CwSLI who completed the paragraph had a word count in the first quartile, and the other three children had word counts in the third or fourth quartile.

Relationship between measures

A one-way repeated-measures ANOVA was conducted with the four literacy measures as the repeated measure for each participant group separately. There was no main effect of literacy measure for either the PLI group (with Greenhouse Geisser corrections, $F(2.34, 119.38) = 1.369$, $p = 0.258$, partial $\eta^2 = 0.026$) or the SLI group $F(3,33) = 1.785$, $p = 0.169$, partial $\eta^2 = 0.140$). Neither group showed dissociation in ability for the different literacy measures.

Table 5 shows the intercorrelations between the literacy measures for the PLI and SLI groups separately. The table suggests that there are differences in the magnitude of the correlations for the two groups; however, it is difficult to test this statistically and make comparisons due to the different group sizes. It is interesting to note that whilst in general the correlations seem to be stronger for the PLI group, the correlations between WR and WE, and RC and WE are higher in the SLI group ($r = 0.68$ and $r = 0.65$, respectively) compared with the PLI group ($r = 0.60$ and $r = 0.56$, respectively). Again it is difficult to test this for significance given the uneven group sizes.

Discussion

The results allow, for the first time, an exploration of the profile of literacy skills in CwPLI. On average, scores on all subtests for CwPLI were at the lower end of the

Table 5. Correlation coefficients for scores on the WIAT-II^{UK} subtests

	PLI group ($n = 59$)[a]				SLI group ($n = 12$)			
	WR	NWR	RC	WE	WR	NWR	RC	WE
Word reading (WR)	–	0.86**	0.81**	0.60**	–	0.50	0.52	0.68*
Non-word reading (NWR)		–	0.73**	0.62**		–	0.13	0.06
Reading comprehension (RC)			–	0.56**			–	0.65*
Written expression (WE)				–				–

Notes: [a]$n = 52$ for correlations with non-word reading. *$p < 0.05$, and **$p < 0.01$.

normal range according to the population norms. For CwSLI, mean scores on all subtests were low, indicating that as a group, CwSLI are impaired on all aspects of literacy. When the mean scores on each aspect of literacy are compared within each group, it can be seen that CwPLI and CwSLI do not show a dissociation between the different aspects of literacy skill. There is heterogeneity in the scores for each aspect of literacy, meaning that these children appear to have an overall global impairment in literacy, rather than showing different levels of impairment for each skill. This contrasts with some other clinical groups, for example, children with autism, whose reading accuracy skills are generally in advance of their reading comprehension skills. However there are a number of differences between the PLI and SLI groups and these will be discussed in turn.

Reading accuracy

Scores for reading accuracy (word reading and non-word reading) in CwPLI were at the lower end of the normal range, and a number of children had a standard score which was at least 1 SD below the population mean on both subtests. This is unexpected considering that CwPLI are not normally characterized by problems with phonological processing, a skill necessary for WR and NWR. Some CwPLI tried to change the non-words into real words. This may reflect strategies encouraged by the reading instruction programme used in their schools or it may have been due to misunderstanding the task. WR scores in the PLI group were lower than those observed in Nation *et al.*'s (2006) ASD group, whilst scores for non-word reading were similar for CwPLI and Nation *et al.*'s ASD group. Nation *et al.* suggested that their participants with ASD may have used strategies such as rote memorization to assist with WR. This provided an explanation for their higher WR compared with NWR ability. It appears that this approach has not been utilized by the PLI group as scores were similar for both measures. For CwSLI, mean reading accuracy scores were very low, with all children attaining a standard score below 90 on both tasks. This is as expected since CwSLI have poor phonological awareness, which is necessary for both of these tasks.

Reading in isolation and in context

The majority of children in both groups had scores in the first or second quartile for WR and RContx. Generally, children also scored in the same quartile on both measures. This suggests that the availability of contextual cues does not disproportionately facilitate CwPLI and CwSLI's ability to decode words any more than typically developing children used in the standardization sample. This could be because children failed to use cues such as pictures and other words to support reading in context. In addition, they may not have used inference skills to make predictions about what the word might be. If the children were struggling with decoding, they might have looked at each word individually rather than trying to decode the sentence as a whole. This would have prevented them from using other words in the sentence to decode the more complex words.

Reading comprehension

CwPLI showed better reading comprehension as a group than CwSLI, but as with reading accuracy, there was a large range of scores in the PLI group, and many CwPLI scored 1 SD or more below the standardization mean; and all but one CwSLI did so. These results contrast with the children with ASD in Nation *et al.*'s study where 65% of children scored 1 SD below the standardization mean (Nation *et al.* 2006). The covariate receptive language ability was significantly related to reading comprehension skill. Therefore, the low RC ability in both groups could be explained by low receptive language skill. Impaired RC could also be due to a resource bottleneck, meaning that all available cognitive resources are devoted to reading accuracy, leaving limited resources for comprehension (Snyder *et al.* 2005). Alternatively, the poor RC scores could be due to 'Matthew Effects', meaning that ongoing decoding difficulties necessitate the need for easier reading material (Stanovich 1986). Children with poor reading accuracy are likely to read less than their peers, meaning they do not gain the same experience in decoding complex text and do not develop their world knowledge resulting in comprehension difficulties.

There was a highly significant correlation between WR and RC for CwPLI. This could be because comprehension ability will be affected to a certain extent by WR ability or because both are reliant on underlying language abilities. Alternatively, it could be due to a non-specific performance difficulty, such as difficulty in understanding task instructions. In addition, when RC ability was compared between groups, with WR as a covariate, there was no longer a significant group difference suggesting that WR has a significant effect on RC score. The majority of CwPLI and CwSLI attained similar scores for WR and RC. This contrasts with children with ASD where WR ability is frequently found to be better than RC ability, for example, only 35% of children in Nation *et al.*'s study obtained scores within 1 SD of each other (2006). The present study provides initial evidence that CwPLI do not present with the same profile of literacy skills as children with high functioning autism, as overall they did not show a discrepancy between WR and RC ability. This would be an interesting area to explore in future research.

Written skills

Turning to written expression, scores for CwPLI were again at the lower end of the normal range. The difficulties that these children possess with oral comprehension, inferencing and integrating information in a text (Botting and Adams 2005), could explain their difficulties with writing (Cragg and Nation 2006). In line with previous studies, the CwSLI had written ability within the impaired range, probably due to the same underlying restrictions on language ability. Other factors such as working memory capacity (Dockrell *et al.* 2007) may also contribute to limited written expression and it would be useful in future work to explore the memory skills of CwPLI.

The majority of participants in both groups obtained very low scores on the writing word fluency measure. This could be due to children struggling to select appropriate words, or access these words from memory, resulting in writing words which are inappropriate, or a delay in writing suitable words. Similarly, the average number of words written by CwPLI for the paragraph was low. In contrast, the CwSLI who wrote the paragraph produced a large number of words, despite having low overall subtest standard scores. This compares to previous studies where CwSLI wrote significantly fewer words than their peers (Mackie and Dockrell 2004, Dockrell *et al.* 2007). This may be explained by the fact that these studies used a writing elicitation task with more constraints on composition than the WIAT-II^{UK}. The apparent lack of written fluency in a group of children (PLI) who are generally marked by their fluency (relative to SLI) is an interesting finding which merits further exploration.

Between group comparisons

For all of the literacy measures CwPLI performed significantly better than CwSLI even when receptive language ability and non-verbal intelligence were controlled for. If group differences cannot be explained by these two factors then it is important to think about other explanations for the disparity. Firstly it may be important to extend the covariate analysis to take account of other areas of language or communication functioning other than a standardized test receptive language score and non-verbal intelligence. Clearly CwPLI possess some ability or have access to experiences which allow them better access to literacy than CwSLI, in this sample at least. In the current study, all of the CwPLI were in mainstream classrooms, whilst a number of the CwSLI were in language units. Children in language units may be given easier tasks than those in mainstream classrooms and may not have had as much exposure to reading and writing as their peers. In addition, it is possible that CwSLI may be used to making more errors in an assessment setting and therefore have limited confidence in formal tasks. An alternative explanation is that there may be another underlying factor such as working memory ability or attention which would explain the differences between the groups. Anecdotally, it was observed that the CwSLI were more easily distracted from the tasks than the CwPLI. This needs to be explored further.

Limitations

There are limitations to the comparisons that can be made between the groups due to the small sample size of the SLI group. Recruitment of CwSLI proved to be difficult. CwPLI were initially recruited for a RCT so parents might have been more willing to consent knowing that their child may receive additional speech and language therapy input. In contrast, there was no potential for additional input for the SLI group. There were also age differences between the groups. This may have affected some of the results because older children have been exposed to more literacy instruction and have more reading and writing experience. However, the age difference was not significant and standard scores were calculated on the basis of what would be expected of a child of that age. There was a difference in the mean Raven's CPM percentiles between groups, with CwSLI having lower scores than CwPLI, but this was not significant and was controlled for in the analysis. In addition, the level of literacy impairment seen in the CwSLI in the present study is similar to that found by Briscoe *et al.* (2001) in their study where participants had average non-verbal intelligence scores. Whilst there are limitations to the use of this comparison group in terms of differences in group size, age and non-verbal intelligence, the findings for the CwSLI in the present study are similar to previous studies of their literacy skills.

Reading comprehension scores could have been affected by the particular items in the WIAT-II^{UK} RC subtest. The subtest measures a number of different comprehension skills (for example, recognizing stated and implied detail, making inferences, drawing conclusions), and therefore children's scores may have been affected by their particular strengths and difficulties. Depending on the age of the participants, some children were presented with the pre-reading items of the WR subtest, whilst others were only presented with the single word reading items. These items may not be tapping the same construct. However, the presence of the pre-reading items removed the floor effects which would have occurred if a measure which only assessed single word reading was used. Additional statistical tests found no significant differences between the standard scores

attained by the younger children who were presented with the pre-reading and single word reading items and the older children presented with the single word reading items only.

An additional limitation is that the WIAT-II^{UK} is a wide range achievement test and therefore does not allow an exploration of more specific aspects of literacy skill. As the PLI group were also involved in the RCT, which involved testing on a number of different measures, there were resource limitations and restrictions to the amount of additional testing which the children could complete. Whilst this study has allowed an initial investigation of the literacy skills of CwPLI, future studies could explore these skills in more depth. For example, examining CwPLIs reading comprehension ability for different types of question such as inferential or literal information.

Finally, it should be noted that multiple ANCOVAs were conducted on the literacy measures. This should be borne in mind when interpreting the results. Whilst we acknowledge that multiple comparisons are not ideal, it was necessary given the missing data on the NWR measure. Multivariate analysis would have led to the loss of this data.

Future research

A large proportion of the participants in the PLI group had reading comprehension scores that were at least 1 SD below the mean. Children with ASD and CwSLI have impaired reading comprehension ability but it is assumed that there are different underlying causes for these difficulties. Children with ASD are reported as having difficulties with comprehension monitoring and failing to integrate world knowledge and previous linguistic information into what they are reading. In contrast, CwSLI struggle with lower level skills such as memory and phonology. Since the source of literacy difficulty directs the choice of instruction and support it will be important to examine whether performance on tasks, such as memory, phonology or inferencing can be used to predict or explain reading comprehension ability in CwPLI. For example, if CwPLI have poor working memory then, coupled with impairments in decoding, it would be difficult for them to retain and process the information needed for reading comprehension tasks. In addition, it would be interesting for future work to explore the abilities of CwPLI, CwSLI and children with ASD on a continuum with other covariates such as a measure of autistic features.

Clinical implications and final conclusions

The results show approximately 40% of CwPLI are impaired in literacy and therefore require some additional literacy support in school. In our sample the majority of CwSLI had literacy impairments and this is well backed up by previous research, but we note that the SLI sample here is small. The clinical implication here is that in a sub-group of children (PLI) with mainly normal structural language abilities, there is still considerable risk of literacy difficulties. These may be the results of 'recovered' language limitations in earlier childhood (the SLI dimension of PLI) or it may be related to limitations akin to those identified by Nation *et al.* in an ASD population, or both. Further research will investigate the relative influences of language and autism functioning on reading ability in this group. This should go some way to confirming or denying Bishop's view of PLI as a condition intermediate between SLI and ASD.

The findings have implications for teachers as they need to be aware of the particular difficulties that their pupils are experiencing. These results also have implications for speech and language therapists who are responsible for the intervention needs of these children. Individualized literacy skill intervention is important for the long-term academic outcome of these children. However, it is important that intervention takes account of any language processing problems and explores the underlying reasons for children's difficulties. For example, by looking at the relationship between performance on reading comprehension and above-sentence level oral comprehension, it can be established whether CwPLI struggle with comprehension to a greater degree when the information has to be read or whether they have a general comprehension deficit. Nation and Norbury (2005) found that 78% of poor comprehenders tested at the age of 8–9 still had significant comprehension difficulties when tested again at the age of 13–14 suggesting that comprehension difficulties can be persistent. Therefore, it is vital that impairments in these skills are tackled early in order to minimize the long-term implications on educational attainment.

Note

1. In the PLI group, due to time constraints, seven children did not complete the NWR subtest. The time limitations were not due to the participants struggling with another subtest, but due to other difficulties such as room-booking constraints and school break times. Therefore, the participants are included in the analysis for the subtests they did complete. There are no missing data for the SLI group.

Acknowledgements

The authors would like to acknowledge the children, families, and all schools involved in the Social Communication Intervention Project for their generous participation; and Kirsty McBean,

Jacqueline Gaile, Gillian Earl, Anna Collins, and Jenny Gibson for additional testing. This research was supported by a grant number EDU/32953 to Catherine Adams and Elaine Lockton by the Nuffield Foundation, London, UK. **Declaration of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

ADAMS, C., LOCKTON, E., GAILE, J., FREED, J., EARL, G., MCBEAN, K., NASH, M. and LAW, J., In preparation, The Social Communication Intervention Project: a randomised controlled trial of speech and language therapy for children who have pragmatic language impairments.

ADAMS, C., CLARKE, E. and HAYNES, R., 2009, Inference and sentence comprehension in children with specific or pragmatic language impairments. *International Journal of Language and Communication Disorders*, **44**, 301–318.

ADAMS, C., COOKE, R., CRUTCHLEY, A., HESKETH, A. and REEVES, D., 2001, *Assessment of Comprehension and Expression 6–11* (Windsor: NFER-Nelson).

ADAMS, C., LLOYD, J., ALDRED, C. and BAXENDALE, J., 2006, Exploring the effects of communication intervention for developmental pragmatic language impairments: a signal-generation study. *International Journal of Language and Communication Disorders*, **41**, 41–65.

BISHOP, D. V., 1992, The underlying nature of specific language impairment. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, **33**, 3–66.

BISHOP, D. V., 1998, Development of the Children's Communication Checklist (CCC): a method for assessing qualitative aspects of communicative impairment in children. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, **39**, 879–891.

BISHOP, D. V., 2000, Pragmatic language impairment: a correlate of SLI, a distinct subgroup, or part of the autistic continuum?. In D. V. Bishop and L. B. Leonard (eds), *Speech and Language Impairments in Children: Causes, Characteristics, Intervention and Outcome* (Hove: Psychology Press), pp. 99–113.

BISHOP, D. V., 2003a, *The Children's Communication Checklist Second Edition* (London: Harcourt Assessment/Psychological Corporation).

BISHOP, D. V., 2003b, *Test for Reception of Grammar Second Edition* (London: Harcourt Assessment).

BISHOP, D. V. and CLARKSON, B., 2003, Written language as a window into residual language deficits: a study of children with persistent and residual speech and language impairments. *Cortex*, **39**, 215–237.

BISHOP, D. V., MCDONALD, D., BIRD, S. and HAYIOU-THOMAS, M. E., 2009, Children who read words accurately despite language impairment: who are they and how do they do it? *Child Development*, **80**, 593–605.

BISHOP, D. V. and NORBURY, C. F., 2002, Exploring the borderlands of autistic disorder and specific language impairment: a study using standardised diagnostic instruments. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, **43**, 917–929.

BOTTING, N. and ADAMS, C., 2005, Semantic and inferencing abilities in children with communication disorders. *International Journal of Language and Communication Disorders*, **40**, 49–66.

BOTTING, N. and CONTI-RAMSDEN, G., 1999, Pragmatic language impairment without autism: the children in question. *Autism*, **3**, 371–396.

BRISCOE, J., BISHOP, D. V. and NORBURY, C. F., 2001, Phonological processing, language, and literacy: a comparison of children with mild-to-moderate sensorineural hearing loss and those with specific language impairment. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, **42**, 329–340.

CONTI-RAMSDEN, G., BOTTING, N., SIMKIN, Z. and KNOX, E., 2001, Follow-up of children attending infant language units: outcomes at 11 years of age. *International Journal of Language and Communication Disorders*, **36**, 207–219.

CRAGG, L. and NATION, K., 2006, Exploring written narrative in children with poor reading comprehension. *Educational Psychology*, **26**, 55–72.

DOCKRELL, J. E., LINDSAY, G., CONNELLY, V. and MACKIE, C., 2007, Constraints in the production of written text in children with specific language impairments. *Exceptional Children*, **73**, 147–164.

FEY, M. E., CATTS, H. W., PROCTOR-WILLIAMS, K., TOMBLIN, J. and ZHANG, X. Y., 2004, Oral and written story composition skills of children with language impairment. *Journal of Speech Language and Hearing Research*, **47**, 1301–1318.

GRIGORENKO, E. L., KLIN, A., PAULS, D. L., SENFT, R., HOOPER, C. and VOLKMAR, F., 2002, A descriptive study of hyperlexia in a clinically referred sample of children with developmental delays. *Journal of Autism and Developmental Disorders*, **32**, 3–12.

LEINONEN, E., LETTS, C. and SMITH, B. R., 2000, *Children's Pragmatic Communication Difficulties (Disorders of Communication)* (London: Whurr).

MACKIE, C. and DOCKRELL, J. E., 2004, The nature of written language deficits in children with SLI. *Journal of Speech Language and Hearing Research*, **47**, 1469–1483.

MINSHEW, N. J., GOLDSTEIN, G., TAYLOR, H. G. and SIEGEL, D. J., 1994, Academic-achievement in high-functioning autistic individuals. *Journal of Clinical and Experimental Neuropsychology*, **16**, 261–270.

NATION, K., CLARKE, P., WRIGHT, B. and WILLIAMS, C., 2006, Patterns of reading ability in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, **36**, 911–919.

NATION, K. and NORBURY, C. F., 2005, Why reading comprehension fails—insights from developmental disorders. *Topics in Language Disorders*, **25**, 21–32.

NEALE, M. D., 1997, *Neale Analysis of Reading Ability II: Second Revised British Edition* (Windsor: NFER-Nelson).

NORBURY, C. F., NASH, M., BAIRD, G. and BISHOP, D. V., 2004, Using a parental checklist to identify diagnostic groups in children with communication impairment: a validation of the Children's Communication Checklist—2. *International Journal of Language and Communication Disorders*, **39**, 345–364.

O'CONNOR, I. M. and KLEIN, P. D., 2004, Exploration of strategies for facilitating the reading comprehension of high-functioning students with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, **34**, 115–127.

RAVEN, J. C., 1979, *Coloured Progressive Matrices* (Oxford: Oxford Psychologists Press Ltd).

SEMEL, E., WIIG, E. H. and SECORD, W., 2006, *Clinical Evaluation of Language Fundamentals—Fourth Edition UK (CELF-4 UK)* (London: Harcourt Assessment).

SHIELDS, J., VARLEY, R., BROKS, P. and SIMPSON, A., 1996, Social cognition in developmental language disorders and high-level autism. *Developmental Medicine and Child Neurology*, **38**, 487–495.

SNOWLING, M., BISHOP, D. V. and STOTHARD, S. E., 2000, Is preschool language impairment a risk factor for dyslexia in adolescence? *Journal of Child Psychology and Psychiatry and Allied Disciplines*, **41**, 587–600.

SNOWLING, M. and FRITH, U., 1986, Comprehension in hyperlexic readers. *Journal of Experimental Child Psychology*, **42**, 392–415.

SNYDER, L., CACCAMISE, D. and WISE, B., 2005, The assessment of reading comprehension—considerations and cautions. *Topics in Language Disorders*, **25**, 33–50.

SPOONER, A. L. R., BADDELEY, A. D. and GATHERCOLE, S. E., 2004, Can reading accuracy and comprehension be separated in the Neale Analysis of Reading Ability? *British Journal of Educational Psychology*, **74**, 187–204.

STANOVICH, K. E., 1986, Matthew effects in reading—some consequences of individual-differences in the acquisition of literacy. *Reading Research Quarterly*, **21**, 360–407.

WECHSLER, D., 2005, *Wechsler Individual Achievement Test. Second UK Edition* (London: Harcourt Assessment).

WINDSOR, J., SCOTT, C. M. and STREET, C. K., 2000, Verb and noun morphology in the spoken and written language of children with language learning disabilities. *Journal of Speech Language and Hearing Research*, **43**, 1322–1336.